

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

BURDEN FOR MANUFACTURE OF CERAMIC MATERIAL

T. V. Chechenya and Ye. A. Osipova



Translation of "Shikhta dlya izgotovleniya keramicheskogo materiala", USSR Patent No, 655691, Opisaniye Izobreteniya k Avtorskemu Svidetel'stvu, (Description of an Invention with Author's Certificate), Published in Bulletin Izobreteniy, No. 13, May 5, 1979, 2 pp.

(NASA-TM-77255) BURDEN FOR MANUFACTURE OF
CERAMIC MATERIAL (National Aeronautics and
Space Administration) 5 p HC A02/MF A01
CSCL 11B

N83-30655

Unclas
G3/27 13178

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546
MAY 1983

ORIGINAL PAGE IS
OF POOR QUALITY

STANDARD TITLE PAGE

1. Report No. NASA TM-77255	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle BURDEN FOR MANUFACTURE OF CERAMIC MATERIAL		5. Report Date May 1983	
		6. Performing Organization Code	
7. Author(s) T. V. Chechenya and Ye. A. Osipova		8. Performing Organization Report No.	
		10. Work Unit No.	
9. Performing Organization Name and Address SCITRAN Box 5456 Santa Barbara, CA 93108		11. Contract or Grant No. NASu- 3542	
		12. Type of Report and Period Covered Translation	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546		14. Sponsoring Agency Code	
15. Supplementary Notes Translation of "Shikhta dlya izgotovleniya keramicheskogo materiala", USSR Patent No. 655691, Opisanie Izobreteniya k Avtorskomu Svidetel'stvu, (Description of an Invention with Author's Certificate), Published in Bulletin Izobreteniy, No. 13, May 5, 1979, 2 pp.			
16. Abstract The invention refers to ceramic materials which can be obtained by methods of powder metallurgy and can be used in high temperature technology.			
17. Key Words (Selected by Author(s))		18. Distribution Statement Unclassified - Unlimited	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 5	22. Price

Description of Invention for Certificate of Authorship 655691.
Applied for 01 October 1976, Application No. 2406926/29-33, Published
05 April 1979, Bulletin No. 13, Date of publication 08 April 1979.
M. K1² C 04 B 35/56, C 04 B 35/58. UDC 066.798.2(088.8).

BURDEN FOR MANUFACTURE OF CERAMIC MATERIAL

T. V. Chechenya and Ye. A. Osipova

The invention refers to ceramic materials which can be obtained /1*
by methods of powder metallurgy and can be used in high temperature
technology.

There are widely known ceramic materials, refractory masses
which are used in high temperature technology [1].

The closest to the invention is burden for the manufacture of
ceramic material which contains silicon carbide, chrome aluminophosphate binding agent, magnesium oxide and chromite. It contains
the indicated ingredients in the following quantities, percent by
weight: silicon carbide 55 - 63, chrome aluminophosphate binding
agent 13 - 17; chromite of fraction less than 0.1 mm 20 - 25; magnesium oxide 3 - 5 [2].

The material has the following physical characteristics:
volumetric weight 2.4 g/cm³; ultimate compression strength (roasting
temperature 1600°C) 6.00 - 7.00 kg/mm²; gas permeability 0.6 - 0.8
l.m./m² hour x wat.col.

The shortcomings of this material are high temperature of
sintering and low mechanical strength. This excludes it from being
used as structural material (for example, material for heat
exchanger frames in gas-turbine engines).

The purpose of the invention is to improve the mechanical
strength of the material.

*Numbers in margin indicate pagination in original text.

In order to achieve this goal, the burden for manufacture of the ceramic material which includes silicon carbide, magnesium oxide and aluminum chrome-phosphate binding agent, also contains silicon nitride with the following ratios of components, percent by weight:

Silicon carbide	32.9 - 47.3
Magnesium oxide	1.3 - 1.5
Aluminum chrome-phosphate binding agent	16.4 - 19.7
Silicon nitride	31.5 - 49.4

The raw material used was: green silicon carbide, silicon nitride, roasted magnesium, chrome aluminum phosphate binding agent. /2

The method of making the material consists of preparing a mass consisting of powder of silicon carbide and chrome aluminum phosphate binding agent to which silicon nitride powder and roasted magnesium are then added. All are carefully mixed and directly before molding, the mass is prepared.

It is molded in steel molds which are chrome-plated on the working surfaces with specific molding pressure of 300 - 1000 kg/cm².

The intermediate products are sintered according to the following technology:

Drying from 20° to 150°C for 5 hours in air.

Sintering from 20 to 700°C for 6 hours and holding at 700°C for one-two hours in air.

The effect of the percentage content of silicon nitride on the strength of the samples is indicated in the table.

A	GPB	SiC	MgO	Si ₃ N ₄ %	Density, g/cm ³	σ_{max} kg/mm ²	σ_c kg/mm ²
1	1	1	1	31.5	2.35	4.45	8.24
1	1	1	1	39.5	2.35	7.10	8.95
1	1	1	1	49.4	2.4	8.10	13.26

As is apparent, the magnitude of strength exceeds the same magnitudes of the known ceramic material ($6 - 7 \text{ kg/mm}^2 - \sigma_c$). The items made of the proposed material, in addition, have low sintering temperature (700°C instead of 1600°C for the known ceramic material). The technology for manufacturing the items is comparatively simple and the employed materials are inexpensive. The volumetric weight of the material is about 2.4 g/cm^3 , thermal stability is $1000 - 20^\circ\text{C}$ of 20 air thermal cycling without destruction.

The proposed ceramic material can be used as structural high-temperature material, for example for heat exchanger frames of a gas-turbine engine.

Formula of the Invention

The burden for making the ceramic material which includes silicon carbide, magnesium oxide and aluminum chrome-phosphate binding agent is distinguished by the fact that in order to improve mechanical strength, it additionally contains silicon nitride with the following component ratio, percent by weight:

Silicon carbide	32.9 - 47.3
Magnesium oxide	1.3 - 1.5
Aluminum chrome-phosphate binding agent	16.4 - 19.7
Silicon nitride	31.5 - 49.4

Sources of information considered in the expert evaluation.

1. USSR Certificate of Authorship No. 348634, k. C 22 c 29/00, 1971.
2. USSR Certificate of Authorship No. 408935, kl. C 04 v 35/56, 1972.